Gas-Particle Interactions Working Group Summary

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Members

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4.	Lawrence Kleinman	Brookhaven National Laboratory
5.	Rao Kotamarthi	Argonne National Laboratory
6.	Alex Laskin	Pacific Northwest National Laboratory
7.	Yin-Nan Lee	Brookhaven National Laboratory
8.	Sasha Madronich	NCAR
9.	Ryan Moffet	Lawrence Berkeley Laboratory
10.	Douglas Worsnop	Aerodyne Research, Inc.
11.	Anthony Wexler	University of California, Davis
12.	Yong Yu	University of California, Irvine
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Our Purview…

Process-oriented field measurements and modeling of aerosol size, composition, and mixing-state evolution, with a focus on

carbonaceous aerosols and their precursors

Major Uncertainties in Aerosol Processes…

- Particle size distribution, composition, density, hygroscopicity, and optical properties of different types of primary and secondary carbonaceous aerosols
  - Gasoline, diesel, cooking, biomass burning POA
  - Anthropogenic, biogenic, and marine SOA
- Evolution of aerosol mixing state via coagulation and condensation, and their effects on optical properties
- Gas-particle partitioning of organic species
  - Inorganic-organic thermodynamics
- Heterogeneous chemistry
  - SOA formation
  - Nighttime N_2O_5 and NO_3

Partial Summary of Current Status…

Gas and Aerosol Instruments

- Particle size and composition measurement capabilities
  - AMS (size-resolved and single particle)
  - SPLAT (single particle)
  - SP2 (size-resolved and single particle)
  - Microprobe and microscopy techniques (single particle)
  - FIMS (aerosol size distribution @ 1 s)
- Gas-phase organics measurement capabilities
  - PTRMS
  - Canister
  - **Currently missing SVOC measurement capability within ASP**

Partial Summary of Current Status…

Aerosol Box Models

- Online aerosol thermodynamics model AIM2
- NCAR Master Chemical Mechanism (MCM)
- Model for Simulating Aerosol Chemistry and Interactions (MOSAIC) – also implemented in 3-D WRF-chem
- Particle-resolved version of MOSAIC, coupled with shell-core optics module

Path Forward…

Process Model Development

- Contribute to the design, development, and evaluation of various ASP-supported aerosol process modules:
  - Inorganic-organic thermodynamics module (Extended-AIM2)
  - Offline SOA module based on MCM + Extended AIM2
  - MOSAIC with SOA (based on MCM + Extended-AIM2)
  - MOSAIC with other available SOA modules (e.g., Rob Griffin's SOA)
- Collaborate with **Organic Aerosol Formation WG** in the use of laboratory measurements to develop and evaluate thermodynamics and SOA formation modules
- Collaborate with the **Optical Properties WG** in the use of laboratory and field measurements of absorption and scattering to conduct local closure experiments

Path Forward…

Process-Oriented Field Measurements

- Contribute to the design and execution of the anticipated clear-air ASP field campaign focused on carbonaceous aerosol evolution
- Consult/involve Tami Bond to develop a size- and composition-resolved emissions inventory
- Develop a coherent aircraft and ground sampling strategy suitable for directly observing time evolution of primary and secondary aerosols
- In addition to the standard 3-D model evaluation of field measurements, conduct detailed box-model analysis of high-resolution gas and particle measurements to gain new and unique insights into aerosol formation and evolution.

Evaluation of Process Modules in 3-D Models…

- Collaborate with the **Modeling WG** to implement reduced and computationally-efficient versions of detailed aerosol chemistry process modules in 3-D regional and global models. Collaborate with 3-D modelers in the evaluation and interpretation of clear-air field measurements using the new aerosol process modules
- Collaborate with **Cloud-Aerosol Interactions WG** to implement new aerosol chemistry modules in CCN activation codes and couple them with cloud-chemistry modules. Collaborate with cloud modelers in the evaluation and interpretation of field measurements using the new aerosol process modules.

Products and Deliverables…

- GPI WG website describing our plans, progress, accomplishments, peer-reviewed publications, and links to various aerosol modules and data products
- Self-documented, publicly accessible detailed aerosol chemistry modules
- Computationally efficient aerosol chemistry modules suitable for use in 3-D regional and global models
- Intercomparison of similar aerosol modules in a box-model framework, with benchmarking where possible
- Peer-reviewed publications